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Beniya et al.

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(54) **PRINTER**

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B41J 11/66 (2006.01)

(52) **U.S. Cl.**
CPC **B41J 11/663** (2013.01)

(58) **Field of Classification Search**
CPC . B41J 11/663; B41J 11/70; B41J 11/68; B41J 11/703; B41J 3/4075; B26D 5/20; B65H 2701/13

See application file for complete search history.

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(57) **ABSTRACT**

A printer includes a transport part that transports a sheet, a printing part that prints on the sheet, a cutting part that cuts the sheet by moving a movable blade toward a stationary blade, and a controller that controls the transport part and the cutting part. When the sheet is label paper having an adhesive layer, the controller controls the transport part and the cutting part to transport the sheet rearward before moving the movable blade that cut the sheet, move the movable blade in a direction away from the stationary blade in a state where the sheet is fed in rearward, and thereafter transport the sheet forward.

4 Claims, 8 Drawing Sheets

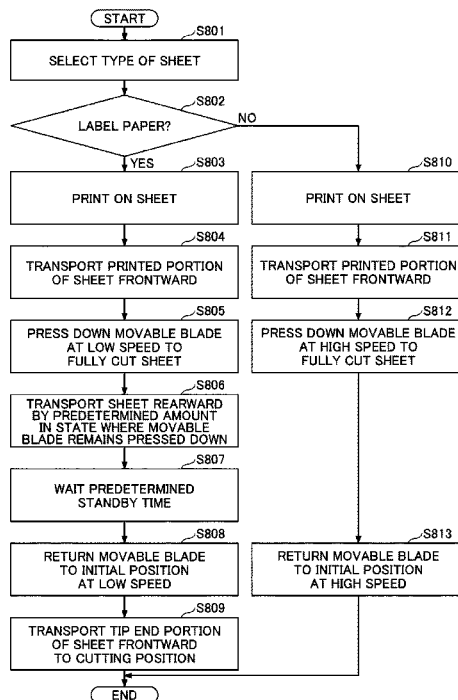


FIG. 1

100

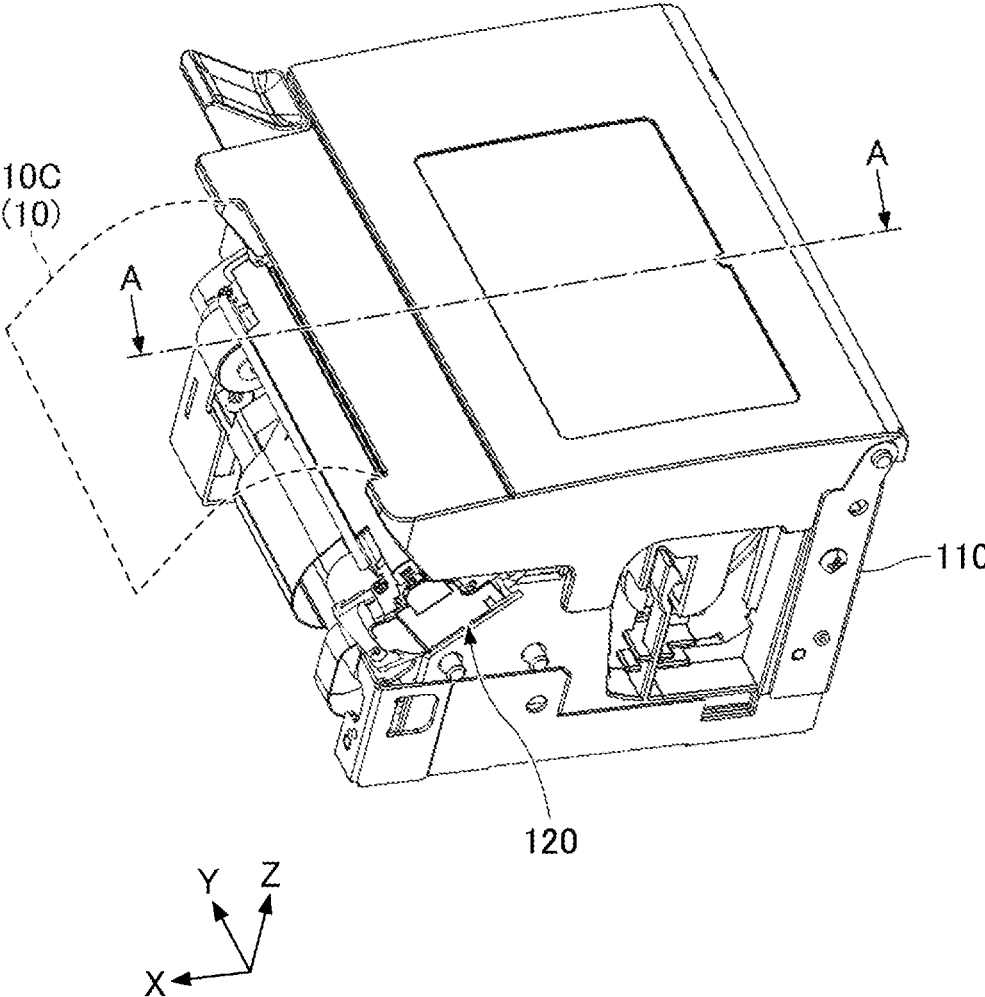


FIG.2

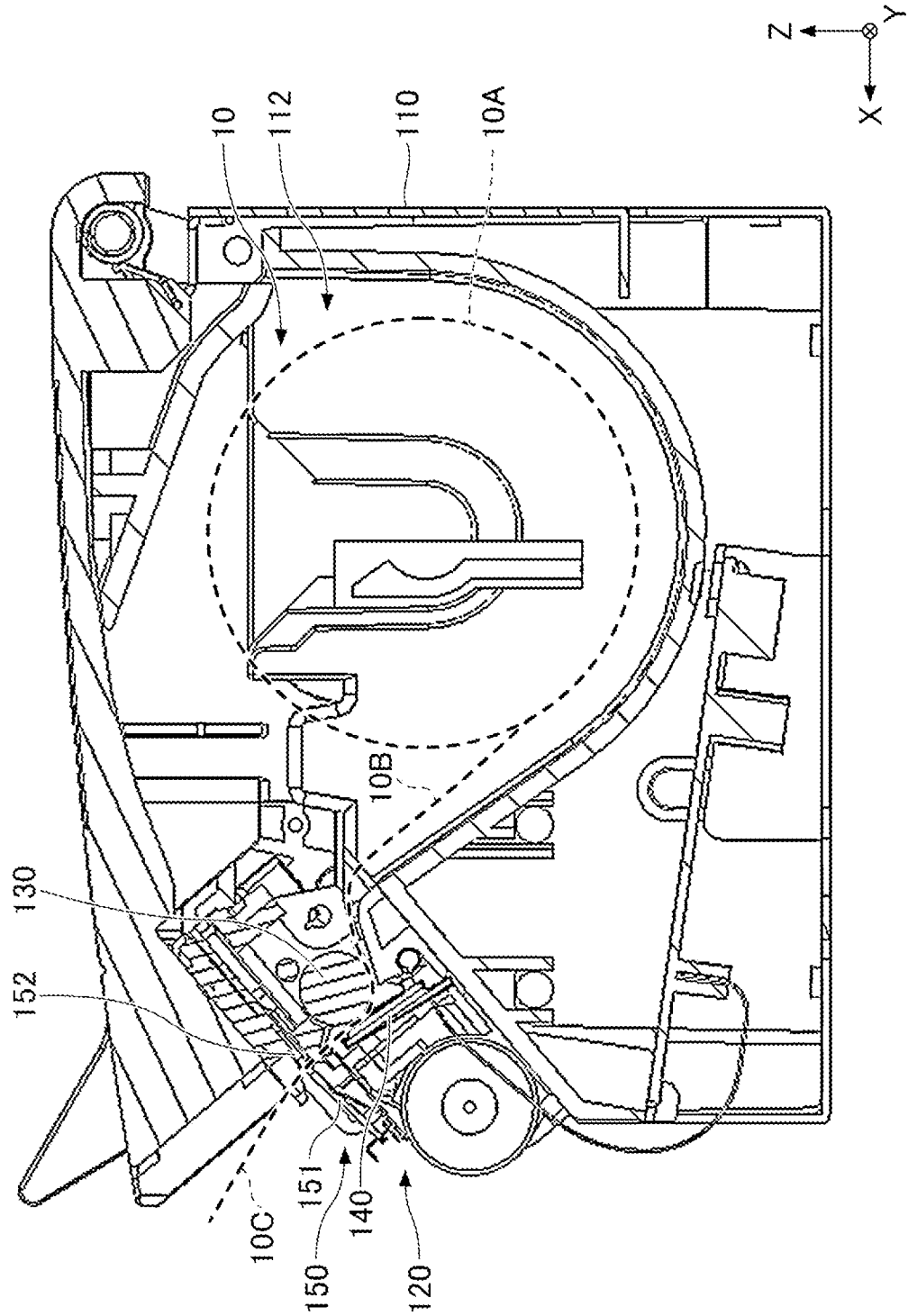


FIG.3

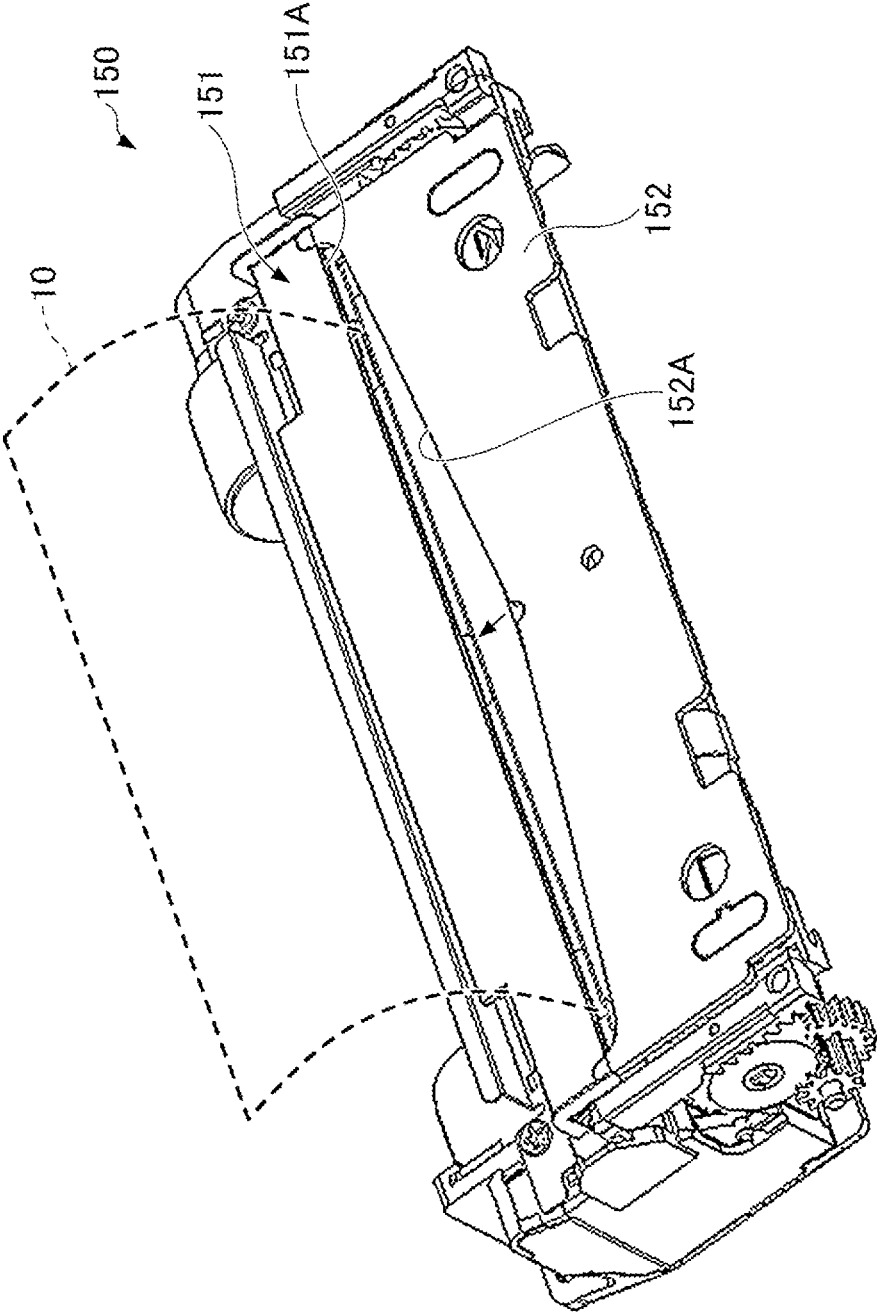


FIG.4

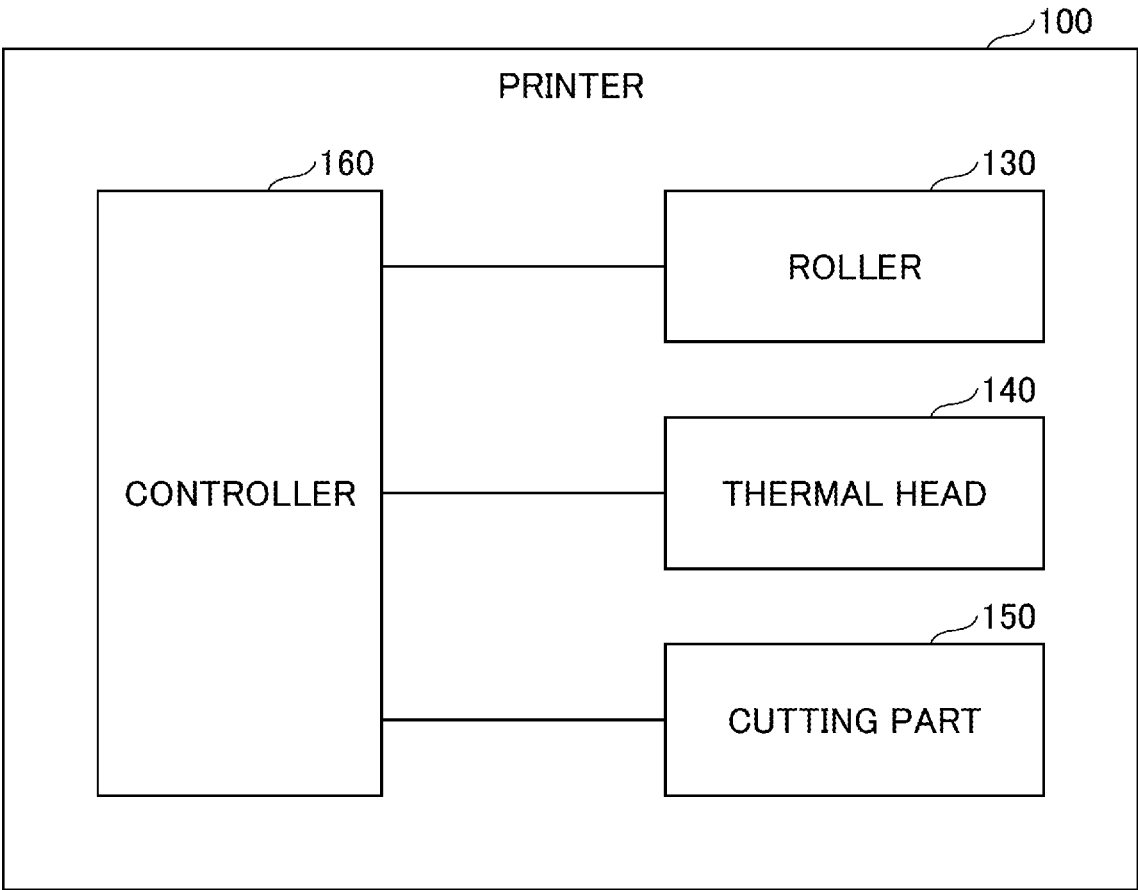


FIG.5

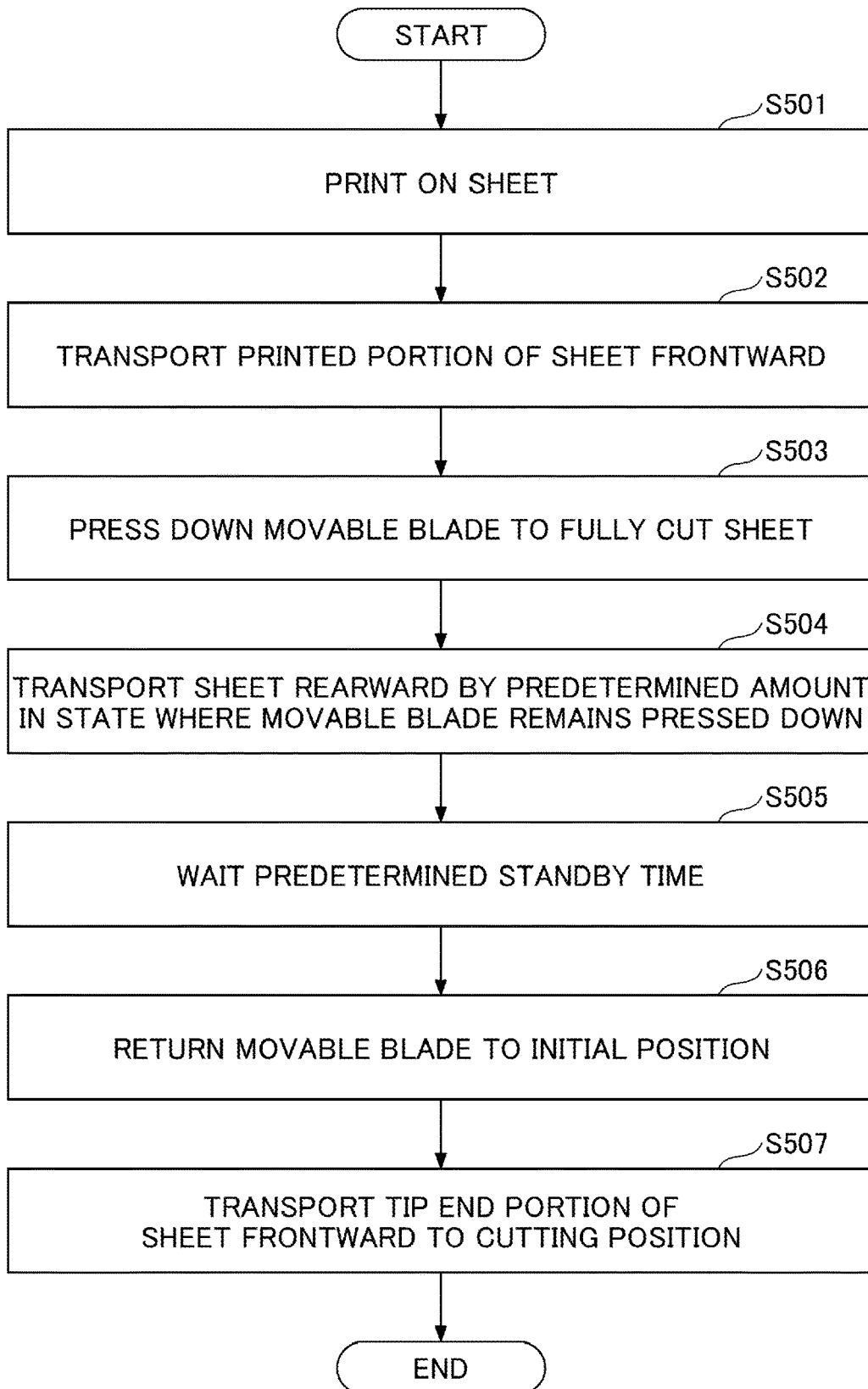


FIG.6A

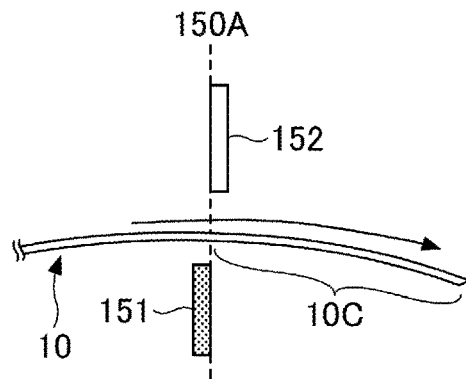


FIG.6B

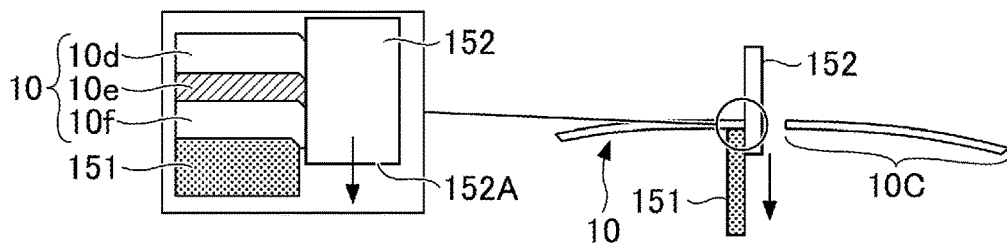


FIG.6C

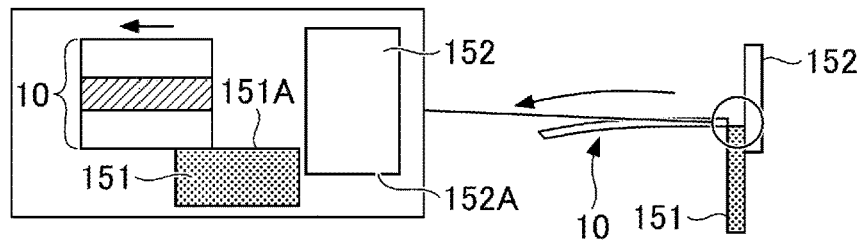


FIG.6D

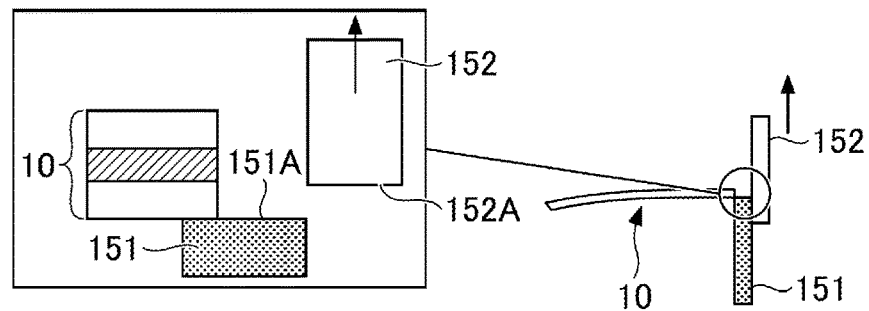
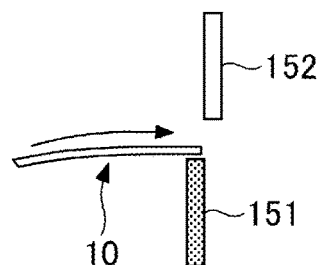


FIG.6E



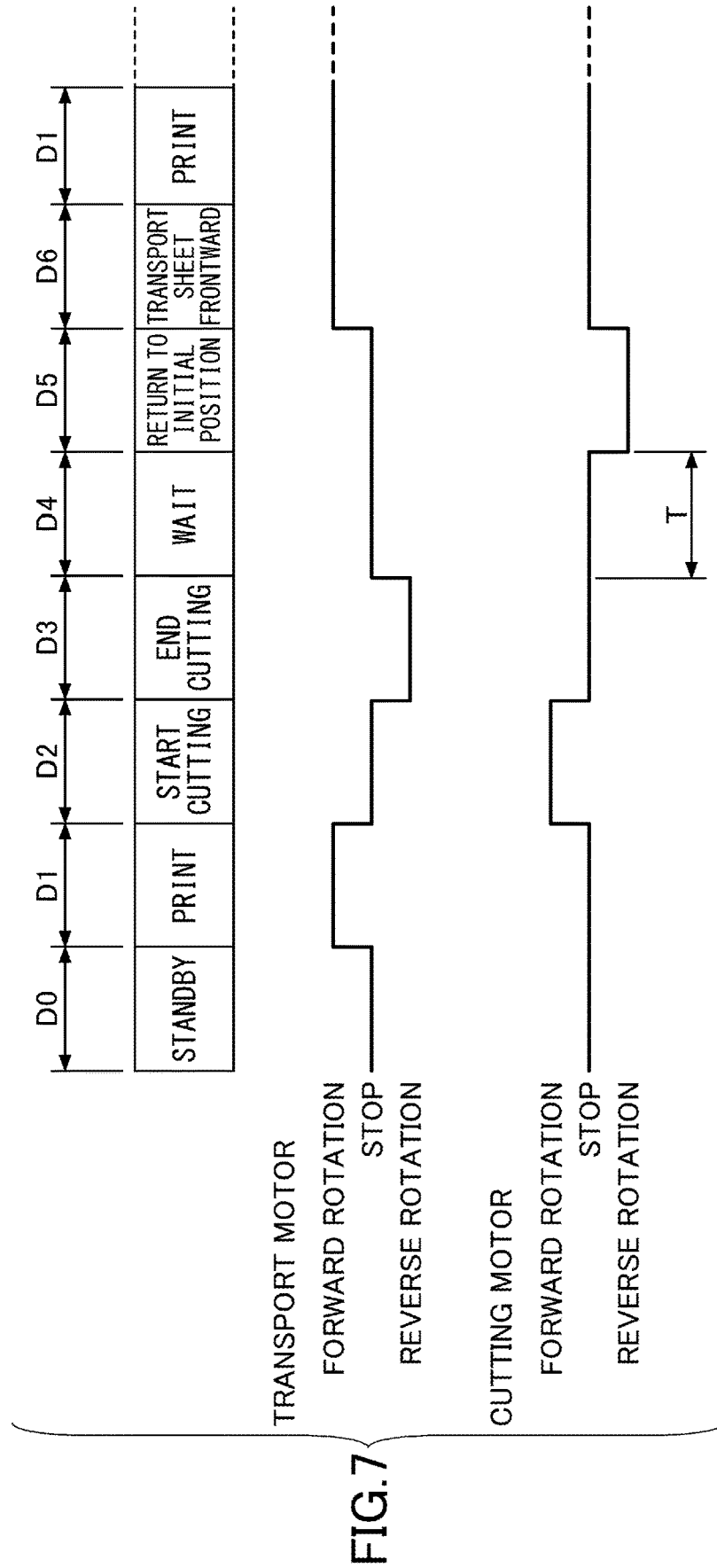
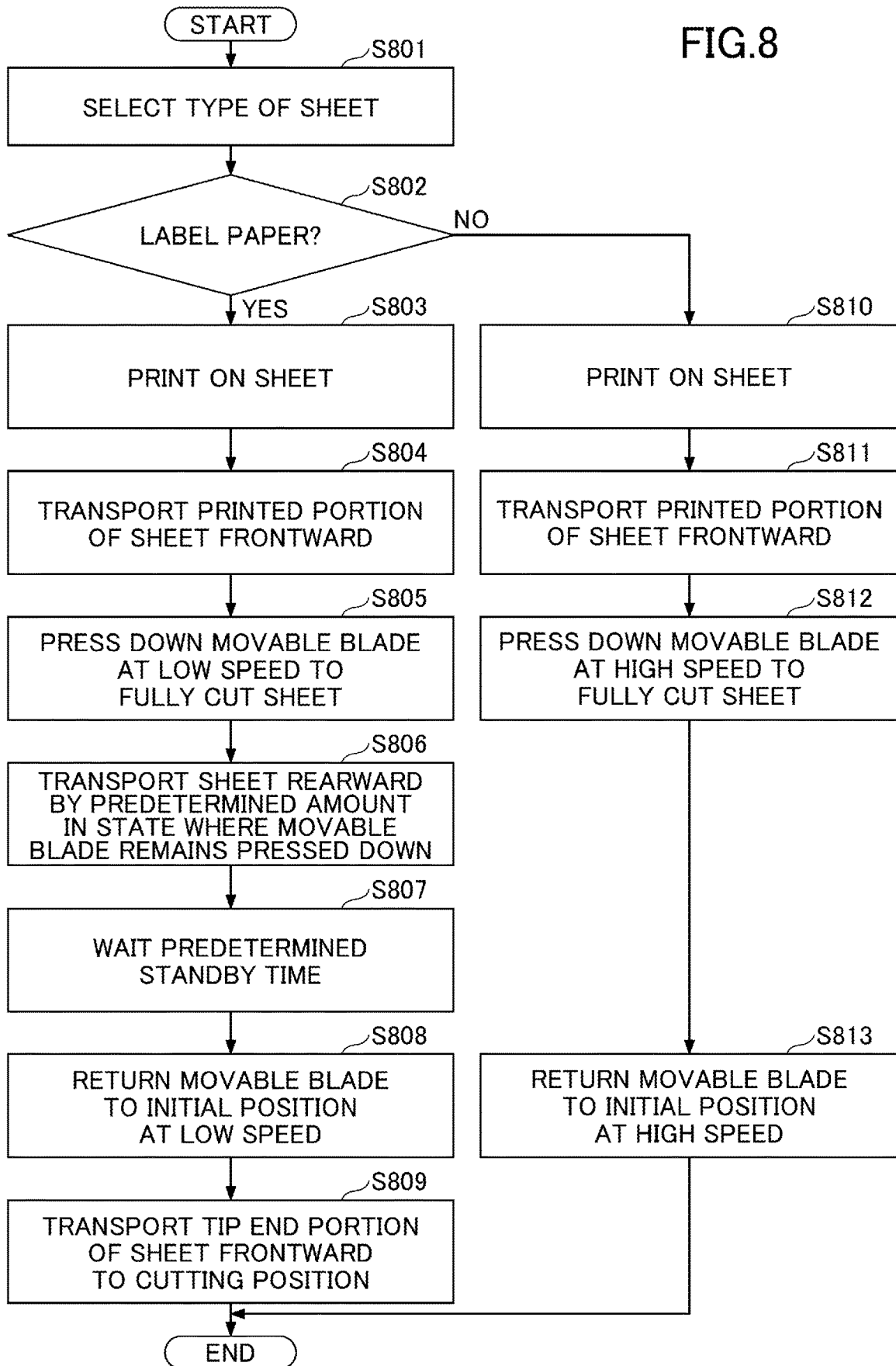


FIG.8



1 PRINTER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the benefit of priority of the prior Japanese Patent Application No. 2021-174548, filed on Oct. 26, 2021, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

A certain aspect of the embodiments is related to a printer.

BACKGROUND

Japanese Laid-Open Patent Publication No. 2002-128378 discloses a technique that partially cuts a sheet using a stationary blade and a movable blade provided with a cutout, and thereafter reverse line-feeds and fully cuts the sheet before retreating the movable blade.

Japanese Laid-Open Patent Publication No. H04-360454 discloses a technique that cuts a sheet by a movable blade, and transports the sheet in a reverse direction before retreating the movable blade to a standby position.

There is a known printer that print on label paper having a plurality of mutually separated labels connected on release paper, and cuts only the release paper. A printer capable of producing a label having an arbitrary size, by printing on label paper having a continuous adhesive layer, is desired.

SUMMARY

A printer according to one embodiment includes a transport part configured to transport a sheet; a printing part configured to print on the sheet; a cutting part configured to cut the sheet by moving a movable blade toward a stationary blade; and a controller configured to control the transport part and the cutting part, wherein the controller, when the sheet is label paper having an adhesive layer, controls the transport part and the cutting part to transport the sheet rearward before moving the movable blade that cut the sheet, move the movable blade in a direction away from the stationary blade in a state where the sheet is fed in rearward, and thereafter transport the sheet forward.

The object and advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the claims.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an external perspective view of a printer according to a first embodiment;

FIG. 2 is a cross sectional view of the printer along a line A-A in FIG. 1;

FIG. 3 is an external perspective view of a cutting part;

FIG. 4 is a block diagram illustrating a configuration of a control system of the printer;

FIG. 5 is a flow chart illustrating a processing procedure of a controller according to the first embodiment;

FIGS. 6A, 6B, 6C, 6D, and 6E are diagrams illustrating an operation of the printer; and

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FIG. 7 is a diagram illustrating operation timings of motors;

FIG. 8 is a flow chart illustrating a processing procedure of the controller according to a second embodiment.

DESCRIPTION OF EMBODIMENTS

Hereinafter, a description will be given of the embodiments of the present invention with reference to the drawings.

When cutting a roll of label paper, if the label paper is cut by the movable blade and the movable blade is returned to a home position, the adhesive layer of the label paper is torn in a moving direction of the movable blade, an adhesive of the adhesive layer easily remains on the movable blade.

One aspect of the embodiments provides a printer that can reduce the adhesive of the label paper from adhering onto the movable blade.

First Embodiment

FIG. 1 is an external perspective view of a printer **100** according to a first embodiment. FIG. 2 is a cross sectional view of the printer **100** along a line A-A in FIG. 1. FIG. 3 is an external perspective view of a cutting part **150** provided in the printer **100**. The printer **100** illustrated in FIGS. 1 and 2 performs printing on a sheet **10** and cutting of the sheet **10**, and is capable of making a full cut.

Hereinafter, an X-axis direction refers to a back-forth direction, and the +X-direction refers to a frontward direction. A Y-axis direction refers to a right-left direction, and the +Y-direction refers to a rightward direction. A Z-axis direction refers to an up-down direction, and the +Z-direction refers to an upward direction.

The printer **100** illustrated in FIGS. 1 through 3 includes a case **110**, and a print unit **120**.

The case **110** has a hollow box shaped configuration. The print unit **120** is disposed at the front inside the case **110**. A holder **112** for holding a roll of the sheet **10** is disposed at the rear inside the case **110**.

For the sake of convenience, the sheet **10** will be described separately for a roll **10A** of the sheet **10**, a drawn-out portion **10B** drawn out to the front from the roll **10A**, and a printed portion **10C** that is printed. Thermal recording paper that can be printed by heat, can be used for the sheet **10**. In the present embodiment, label paper having an adhesive layer, and a plain paper having no adhesive layer, can be used for the sheet **10**.

The print unit **120** includes a roller **130** (an example of a transport part) for transporting the sheet **10**, a thermal head **140** (an example of a printing part), and a cutting part **150**.

The roller **130** is pressed against an upper surface of the drawn-out portion **10B**, and is rotated by a transport motor (not illustrated) to transport the sheet **10**. The roller **130** transports the sheet **10** forward when the transport motor is rotated in a forward direction, and transports the sheet **10** rearward when the transport motor is rotated in a reverse direction.

The thermal head **140** includes a plurality of heating elements (not illustrated) disposed in a width direction of the sheet **10**. The thermal head **140** heats the sheet **10** by the heating elements, and prints an image on the sheet **10**.

The cutting part **150** includes a stationary blade **151** made of a metal and having a flat shape, and a movable blade **152**, for example. A cutting edge **151A** of the stationary blade **151**, and a cutting edge **152A** of the movable blade **152**, are both greater than the width of the sheet **10**.

The stationary blade **151** and the movable blade **152** are disposed so that the respective cutting edges **151A** and **152A** oppose each other. The movable blade **152** is driven by a cut motor (not illustrated), and is movable in a direction toward and in a direction away from the stationary blade **151**. The cutting part **150** moves the movable blade **152** toward the stationary blade **151**, and presses the movable blade **152** down toward the sheet **10** at a cutting position **150A** (refer to FIG. **6A** described later) between the cutting edge **151A** and the cutting edge **152A**. Accordingly, a rear end of the printed portion **10C** is pinched between and cut by the cutting edges **151A** and **152A**, and the printed portion **10C** is cut off from the sheet **10**.

As illustrated in FIG. **3**, the cutting edge **151A** has a linear shape, while the cutting edge **152A** has a concave V-shape that caves in from both ends of the movable blade **152** toward a center thereof so as to separate further away from the stationary blade **151**. Accordingly, when the cutting edge **152A** is pressed down, the sheet **10** is cut from both the right and left ends thereof toward the center thereof.

FIG. **4** illustrates a configuration of a control system of the printer **100**. The printer **100** includes a controller **160**. The controller **160** controls operations of various parts of the printer **100**, including printing to the sheet **10** by the thermal head **140**, transporting the sheet **10** by the roller **130**, and cutting the sheet **10** by the cutting part **150**. For example, the controller **160** includes a processor, a non-volatile memory, or the like. The controller **160** can provide various functions by executing one or more programs stored in the non-volatile memory by the processor.

FIG. **5** illustrates a processing procedure of the controller **160**, including steps **S501** through **S507**. FIGS. **6A** through **6E** illustrate the operation of the printer **100** according to the first embodiment. In the example of the present embodiment, the printer **100** is a printer exclusively for label printing.

As illustrated in FIG. **6A**, after the controller **160** controls the thermal head **140** to print on the sheet **10** (step **S501**), the controller **160** controls the roller **130** to transport the sheet **10** frontward to so that the printed portion **10C** is located at a position more frontward than the cutting position **150A** (step **S502**). A length of a printing area is variable according to printing contents.

As illustrated in FIG. **6B**, the controller **160** controls the movable blade **152** press down toward the stationary blade **151**, and cut the rear end of the printed portion **10C** (step **S503**). In the present embodiment, the sheet **10** is fully cut. As a result, the printed portion **10C** is cut off from the sheet **10**. In this state, as illustrated in FIG. **6B**, an adhesive of an adhesive layer **10e** exposed from a tip end surface of the cut sheet **10** may adhere to a surface of the movable blade **152** on the side closer to the drawn-out portion **10B** than to the drawn-out portion **10C**. As illustrated in FIG. **6B**, the sheet **10** includes a heat sensitive layer **10d**, the adhesive layer **10e**, and release paper **10f**, in this order from the side of a printing surface of the sheet **10**.

Next, as illustrated in FIG. **6C**, the controller **160** controls the roller **130** to transport the sheet **10** rearward by a predetermined amount, in a state where the movable blade **152** remains pressed down, so as to create a gap between the tip end surface of the sheet **10** and the surface of the movable blade **152** on the side closer to the drawn-out portion **10B** than to the drawn-out portion **10C** (step **S504**). In this state, the predetermined amount of the sheet **10** fed rearward is at least an amount that can create the gap between the tip end surface of the sheet **10** and the movable blade **152**, and a

suitable value can be obtained in advance for the predetermined amount by conducting experiments, simulations, or the like.

Thereafter, the controller **160** stands by and waits for a predetermined standby time **T** (step **S505**). The standby time **T** is at least a time that is sufficiently long to enable the adhesive to be completely separated from the movable blade **152**, and a suitable value can be obtained in advance for the standby time **T** by conducting experiments, simulations, or the like.

Next, as illustrated in FIG. **6D**, the controller **160** controls the movable blade **152** to move in a direction away from the stationary blade **151**, to return the movable blade **152** to an initial position (step **S506**).

Further, as illustrated in FIG. **6E**, the controller **160** controls the roller **130** to transport the tip end of the sheet **10** frontward to the cutting position **150A** (step **S507**). Thereafter, the controller **160** ends the series of processes illustrated in FIG. **5**.

FIG. **7** illustrates operation timings of motors under the control of the controller **160**. FIG. **7** illustrates the operation timing of the transfer motor, and the operation timing of the cut motor. In FIG. **7**, **D0** through **D6** denote periods (or time segments) of the processes of the controller **160**.

When the controller **160** stands by during the period **D0** after the printer **100** is activated and until a print start instruction is received, and the print start instruction is thereafter received, the controller **160** controls the thermal head **140** to print on the sheet **10** during the period **D1** while controlling the transport motor to rotate in the forward direction to transport the sheet **100** frontward.

Next, the controller **160** stops the transfer motor, and also controls the cut motor to rotate in a forward direction to press down the movable blade **152** toward the stationary blade **151**, to cut the rear end of the printed portion **10C** during the period **D2**.

Next, the controller **160** stops the cut motor, and also controls the transport motor to rotate in the reverse direction in a state where the movable blade **152** remains pressed down, to transport the sheet **100** rearward by the predetermined amount during the period **D3**.

Thereafter, the controller **160** stops the transfer motor and stands by and waits for the standby time **T** during the period **D4**.

Next, the controller **160** controls the cut motor to rotate in a reverse direction to move the movable blade **152** in the direction away from the stationary blade **151**, to return the movable blade **152** back to the initial position during the period **D5**.

Furthermore, the controller **160** controls the transport motor to rotate in the forward direction and transport the tip end portion of the sheet **10** to the cutting position **150A** during the period **D6**. Thereafter, the controller **160** performs the processes of the period **D1** and subsequent periods as a printing process for a next page, as required.

Second Embodiment

FIG. **8** illustrates the processing procedure of the controller **160** according to a second embodiment, including steps **S801** through **S813**. The printer **100** according to the second embodiment is a shared printer capable of printing on the label paper and plain paper. In the second embodiment, the processing procedure of the controller **160** is different from that of the first embodiment.

The controller **160** urges a user to select a type of sheet **10** (step **S801**). The type of sheet **10** may be selected manually

by the user, or the sheet **10** may be provided with an identifier, such as symbols, graphics, characters, bar codes, and two-dimensional codes, so as to enable the printer **100** to automatically recognize the type of sheet from the identifier.

Next, the controller **160** determines whether or not the selected type of sheet **10** is label paper (step **S802**).

When the type of sheet **10** is the label paper (YES in step **S802**), the controller **160** transports the sheet **10** frontward after printing on the sheet **10** (step **S803**), and positions the printed portion **10C** more frontward than the cutting position **150A** (step **S804**).

Then, the controller **160** presses down the movable blade **152** at a low speed (for example, 1000 pps) toward the stationary blade **151**, to cut the rear end of the printed portion **10C** (step **S805**). As a result, the printed portion **10C** is separated from the sheet **10**.

Next, the controller **160** transports the sheet **10** rearward in the state where the movable blade **152** remains pressed down, to create the gap between the front end of the sheet **10** and the surface of the movable blade **152** (step **S806**). Thereafter, the controller **160** waits for the standby time **T** (step **S807**).

Next, the controller **160** moves the movable blade **152** in the direction away from the stationary blade **151** at a low speed (for example, 1000 pps), to return the movable blade **152** back to the initial position (step **S808**).

Further, the controller **160** transports the sheet **10** frontward to the cutting position **150A** (step **S809**), and thereafter ends the series of processes illustrated in FIG. **8**.

On the other hand, when the type of sheet **10** is the plain paper (NO in step **S802**), the controller **160** transports the sheet **10** frontward after printing on the sheet **10** (step **S810**), and positions the printed portion **10C** more the frontward than the cutting position **150A** (step **S811**).

Then, the controller **160** presses down the movable blade **152** at a high speed (for example, 3000 pps) toward the stationary blade **151**, to fully cut the rear end of the printed portion **10C** (step **S812**). As a result, the printed portion **10C** is separated from the sheet **10**.

Next, the controller **160** moves the movable blade **152** in the direction away from the stationary blade **151** at a high speed (for example, 3000 pps), to return the movable blade **152** back to the initial position (step **S813**). Thereafter, the controller **160** ends the series of processes illustrated in FIG. **8**.

As described above, the disclosed printer transports the label paper rearward in the state where the movable blade remains pressed down after cutting the label paper, and after moving the movable blade in the direction away from the stationary blade, then transports the label paper frontward. Hence, when returning the movable blade back to the initial position, it is possible to prevent the adhesive exposed from the end surface of the label paper from adhering onto the movable blade. Particularly in a case where the label paper is fed rearward during a standby in which moving the movable blade in the direction away from the stationary blade is waited in the state where the movable blade remains pressed down after cutting the label paper, the adhesive that adheres to the movable blade **152** when the movable blade **152** is pressed down can be released or removed during standby.

The disclosed controller can return the movable blade back to the initial position without transporting the sheet rearward after cutting the sheet, according to the type of sheet, such as the plain paper. Accordingly, the process of transporting the cut sheet rearward after cutting, and the

process of transporting the sheet frontward to the cutting position, can be omitted when the plain paper or the like is used, thereby shortening a processing time related to the cutting of the sheet.

In the disclosed printer, a cutting speed of the label paper can be made slower than a cutting speed of the plain paper. In this case, the cutting speed can be reduced when the label paper is used, so that the label paper that is thicker than the plain paper can be cut with a sufficiently large torque. On the other hand, because the cutting speed can be increased when the plain paper is used, the processing time related to cutting of the plain paper can be reduced.

All examples and conditional language provided herein are intended for the purposes of aiding the reader in understanding the invention and the concepts contributed by the inventor to further the art, and are not to be construed as limitations to such specifically recited examples and conditions, nor does the organization of such examples in the specification relate to a showing of the superiority and inferiority of the invention. Although one or more embodiments of the present invention have been described in detail, it should be understood that the various changes, substitutions, and alterations could be made hereto without departing from the spirit and scope of the invention.

Although the embodiments are numbered with, for example, "first," or "second," the ordinal numbers do not imply priorities of the embodiments. Many other variations and modifications will be apparent to those skilled in the art.

What is claimed is:

1. A printer comprising:

a transport part configured to transport a sheet;
a printing part configured to print on the sheet;
a cutting part configured to cut the sheet by moving a movable blade toward a stationary blade; and
a controller configured to control the transport part and the cutting part,

wherein the controller, when the sheet is label paper having an adhesive layer, controls the transport part and the cutting part to transport the sheet rearward before moving the movable blade that cut the sheet,

move the movable blade in a direction away from the stationary blade in a state where the sheet is fed in rearward, and
thereafter transport the sheet frontward.

2. The printer as claimed in claim **1**, wherein controller varies a cutting speed of the sheet by the movable blade according to a type of the sheet.

3. A printer comprising:

a transport part configured to transport a sheet;
a printing part configured to print on the sheet;
a cutting part configured to cut the sheet by moving a movable blade toward a stationary blade; and
a controller configured to control the transport part and the cutting part,

wherein the controller switches, according to a type of the sheet, between

an operation that transports the sheet rearward before moving the movable blade that cut the sheet, moves the movable blade in a direction away from the stationary blade in a state where the sheet is fed in rearward, and thereafter transports the sheet frontward, and

an operation that moves the movable blade toward the stationary blade to cut the sheet, and thereafter

moves the movable blade in the direction away from the stationary blade without transporting the sheet rearward.

4. The printer as claimed in claim 3, wherein controller varies a cutting speed of the sheet by the movable blade according to the type of the sheet.

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